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Original Research Article

Correlation between the Measurement of the Umbilical Cord Diameter and the Birth Weight Outcome, in Sudanese Neonates

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ABSTRACT

Objectives: The study was aimed to establish a potential relationship between the measurement of umbilical cord diameter and the birth weight in labor room, in Sudanese neonates.
Materials and Methods: Diameter of one thousand and twenty umbilical cords of both sexes, single and twins birth of full term Sudanese neonates was measured immediately after delivery in the labor room, using Vernier Calipers, then their neonatal weight was measured, using Siltec electronic baby weighing scale BS1. Data were analyzed by Statistical Package for Social Science version 16 (SPSS).
Results: Average umbilical cord diameter in Sudanese neonates is about 1.5 cm, being bigger in single males than females, but in twin males and females were about the same. The average neonatal weight at birth is 3100 grams is single neonate and 2400 grams in twin, being bigger in males neonates. Strong correlation was found between the cord diameter and neonatal weights at the delivery P-Value is (0.000). The study shows that each (0.1mm) of cord diameter equal (300) grams of the birth weight (0.1= 300), thus measurement of cord diameter at birth, can help for detection of neonatal weight at the birth. It is concluded that neonatal weight can be detecting at the labor room by measuring cord diameters in mm, then multiple cord measuring in mm × 3000 grams.
Recommendation: is it recommended that measurement of the cord diameter in the labor room can be using as one of the neonatal weighing methods measurement at the birth.

Key words: Sudanese, umbilical cord diameter, and birth weight**.**

INTRODUCTION

Studying morphological features of the Human umbilical cord before and after delivery is important, because the umbilical cord play an essential role in fetal intrauterine survival. It acts as a supply line between the developing fetus and his mother, [(1)] but it's one of the least studied components of the fetal membranes anatomy during delivery. The ability of the fetus to grow and thrive in utero is presumed to be a function of the umbilical cord and the placenta. The umbilical cord diameter (UCD) play important role in fetal blood follows and fetal weight gain. The birth weight is an important determinant of child survival, healthy growth and development. low birth weight is a well-established risk factor for adverse long term health, particularly cardiovascular disease and metabolic syndrome

The human umbilical cord average diameter is 1.5 up to 3 cm and average circumference of 3.6 cm at birth. The cords

can be large (thick) and exceed an average of 4cm especially at the umbilicus, [2-4] or can be thin, less than 1cm lacks Wharton's jelly. The cord diameter is depending on the amount of Wharton's jelly, small diameter suggested by poor nutrition and lack of glycogen in fetal tissues and small amount of the Wharton's jelly. [5-7] Wharton's jelly is a specialized tissue serving many purposes for the developing fetus. It is a gelatinous substance largely made up of mucopolysaccharides, some fibroblasts and macrophages. [4,7] These properties give it elastic and cushion effects, which can tolerate the vibrations, bending, stretching and twisting of the active fetus. In addition, it holds and protects the vessels and regulates the blood flow, to plays a role in providing nutrition to the fetus, stores chemicals for the onset of labor. This property serves to protect the critical vascular lifeline between the placenta and fetus. Wharton's jelly, when exposed to temperature changes, collapses structures within the umbilical cord and thus will provide a physiological clamping of the cord, after an average of 5 minutes following birth. [7-9] It is believed that males have more Wharton's jelly content than the females and that good nutrition increases the amount. It tends to decrease with gestational age and can disappear when pregnancies go beyond 40 weeks. [7]

Many studies were done to measure cord diameter, [10-16] but most of them were evaluate cord diameter prenatally using sonographic methods. Prenatal measurement of the umbilical cord diameter sonographically is technically difficult and takes time for scanning, because the cord is routinely not seen visible from end to end by sonographic. After delivery the cord is visible from end to end, visibility of the cord help to measure cord diameter in different regions or points through the cord length, this significantly gives good results about cord diameter measurement. The study was aimed to assess the umbilical diameter postnatal at the birth, in single and twin neonates of the normal vaginal delivery, and establish a potential relationship between the cord diameter and the neonatal weight at the birth in the labor room, in Sudanese neonates.

MATERIALS AND METHODS

Diameters of 1020 umbilical cords of both sexes were measured, using Vernier Calipers. The study was conducted in the department of Obstetrics and Gynecology, Omdurman Maternity Hospital, in 2014, Sudan, which is a main referral Maternity Hospital, with a high incidence rate of deliveries; it receives different cases of normal and abnormal deliveries from different areas.

The study includes; full term neonates of both sexes of normal vaginal delivery and look healthy neonates, at the period of the study. The study excludes; still birth, caesarean sections, and abnormal vaginal deliveries and look unhealthy neonates. To avoid the structures changes of the umbilical cord after birth, the diameter was immediately measured in the first two minutes after the delivery, because the Wharton's jelly, when exposed to room temperature its structures can changes and collapses after an average of 5 minutes following birth. [7-9] The measurement was applied to five different selected points of the cord length. Two peripheral ends (fetal and placental), and other three points in between them, then the average measurement was taken. Then neonatal weight was measured using Siltec electronic baby weighing scale BS1. Data were entered to computer software programs and analyzed using Statistical Package for Social Science version 16 (SPSS, V16. Aromonk, NY: IBM Corp, USA). Percentage, mean, standard deviation and correlation are taken to identify the association between variables, and confidence interval of a P–value equal 0.05 or less as consider statistically significant.

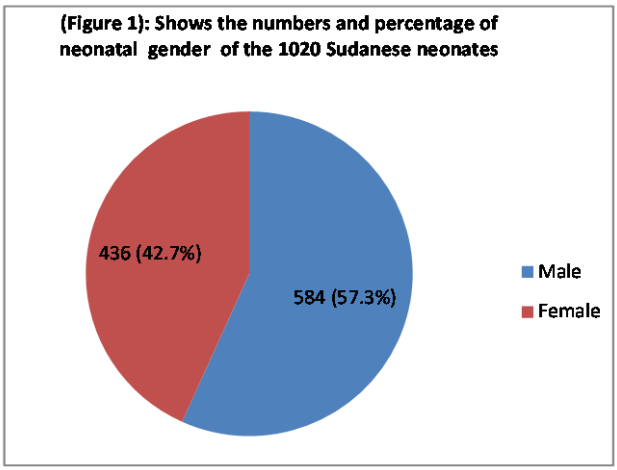
RESULTS

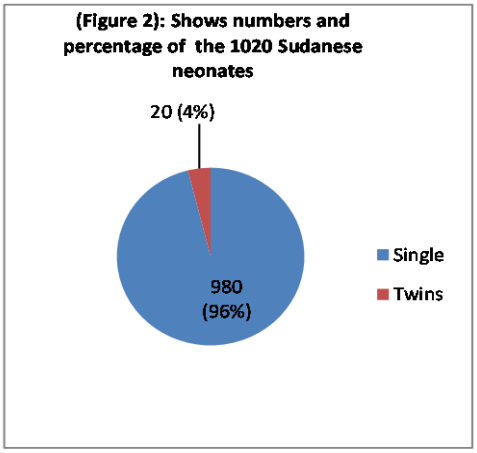
Out of 1020 neonates, 584 (57.3%) were males and 436 (42.7%) were females

babies, (Fig. 1), and980 (96%) were single and 20(4%) were twins babies, (Fig. 2). The weight of the single birth ranged from 1200 to 5000 gram with mean (3.1806 ± .45242 std-deviation) in male and from 2000 to 4100 gram with mean (3.1257 ± .29401 std-deviation) in female. The weight of the twin birth ranged from 1900 to 3200 gram with (mean 2.6250±.49785 std- deviation) in male and from 1300 to 3000 gram with mean (2.2833±.67532 std- deviation) in female, (Table 1).

(Table 1): shows neonatal weight in grams in the single and twin birth

Gender of the neonate	Birth outcome	Minimum	Maximum	Mean/SD
Male	Single	1200	5000	3.806/.45242
	Twin	1900	3200	2.6250/.49785
Female	Single	2000	4100	3.1257/.29401
	Twin	1300	3000	2.2833/.67532
Total (1020) neonates				





The diameter of the umbilical cord in single birth babies ranged from 0.5 to 2.5 cm. with means (1.1582 ± .24093 std-deviation) in males, and from 0.5 to 1.6 cm. with mean (1.0939± .16011 std- deviation) in females. In twins babies the cord diameter ranged from 0.8 to 1.2 cm. with mean (.9±.18516 std-deviation) in males and from 0.7 to 1.2 cm with mean (.9 ± .17056 std-deviation) in females, (Table 2), (Fig 3).

(Table 2): shows umbilical cord diameter in single and twin Sudanese neonates

gender of the neonate	Birth outcomes	Minimum	Maximum	Mean/SD
Male	Single	0.5	2.5	1.1582/ 0.24093
	Twin	0.8	1.2	0.9000/0.18516
Female	Single	0.5	1.6	1.0939/0.16011
	Twin	0.70	1.2	0.9000/0.17056
Total (1020) neonates				

(Figure 3): shows diameter of the umbilical cord
A. Cord with small diameter, B. Cord with medium diameter and C. Cord with large diameter

Correlations

(Table 3): shows correlations between the umbilical cord diameter and neonatal weight, in Sudanese neonates

Correlation	Variable	Person Chi- square	P-Value
Neonatal Weight	Umbilical cord diameter	0.744	0.000*
Total 1020 neonate			

* means significant correlation

DISCUSSION

The presence of a thin cord during pregnancy places the fetus at risk of restricted growth and birth weight, classified as small for gestational age. The cord diameter is depending on the amount of Wharton's jelly, reduction in the amount of Wharton's jelly decrease diameter. Goodlin [(17)] in 1987, studied the correlate between umbilical cord diameter and the area of Wharton's jelly, fetal loss, premature birth and inadequate fetal growth, he found significant correlation between the cord diameter and amount Wharton's jelly he reported that, the cord diameter referred to the amount of Wharton's jelly. Weismann, [(18)] in 1987, calculated the area of Wharton's jelly at different gestational age, he described that, there was increase in cord diameter due to increase in amount of Wharton's jelly till week 34 then it stabilized. The study of Sepulveda [(3)] 2003 and Barbieri [(4)] 2011, showed that there was an increase in the amount of Wharton's jelly as a function of gestational age until 32 weeks, after which it remained practically stable until the end of the pregnancy, they described average cord diameter was about(1.5 cm) at birth. The present study showed that, the average umbilical cord diameter in single male neonate is about (1.2cm), and in single female neonate is (1cm).in twin male and female neonates is about the same witch is (.,9 cm). However the finding of this study confirms the most of pervious findings, and the finding of Sepulveda [(3)] *et al* in 2003, and Barbieri [(4)] *et al*, 2011, because it is believed that males have more Wharton's jelly content than do females. The UCD in the present study was found not to exceed 2.5 cm, if diameter of the cord exceeds 2.5 cm; it is suggest cord with large diameter, this was found in cord with edema, tumor and hernia or associated multiple cysts, because all are increase cord diameter.

Togni [(6)] *et al.* in 2007, study UC described a weak correlation between mount of Wharton's jelly, cord diameter and neonatal weight, while the study of Barbieri [(4)] *et al*. 2011, showed direct relationship between gestational age, fetal weight and mount of the Wharton's jelly of the UC. A significant correlation was found in the present study between UCD and neonatal weight, P-V 0.000, this study in agrees with the study of Barbieri [(4)] *et al*.2011. Cords with big diameter were associated with high birth weight. These finding were in agreement with the finding of Sepulveda [(3)] *et al*, 2003, who found that big cord are associated with high birth weight and in contrast to the small ones. Because the more Wharton's jelly increase cord diameter as well as blood vessels size that increase amount of blood flow and nutrition in which fetal weight gain increased. The present study found a significant correlation between UCD and neonatal weight; it is demonstrated from this work that each (0.1 mm) of UCD equals (300 grams) of neonatal weight. For the neonatal weight estimation at the labor room, measure cord diameters in mm, then multiple cord measuring in × 3000 grams (0.1 CM= 300 Grams). Equation (neonatal weigh in grams = cord diameter in mm ×300grams). This result may help for diction the birth weight at the labor room. And will be more effective in the normocoiled cord, because the hypercoiled reduce blood flow in which the fetal weight will be slow or than normal.

It concludes that the average cord diameter in Sudanese neonates about 1.5 cm, being big in males and single birth, and its correlates birth weight. Measurement of cord diameter can help for detection of the neonatal weight at the birth, and be use as

one of the neonatal weighing methods at the birth.

List of abbreviations

Abbreviations	Wards
UCD	Umbilical cord diameter
UC	Umbilical cord
SD	Standard deviation
SPSS	Statistical Package for Social Science version 16

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